

## CLAIMS

1. A plasma reactor comprising a pair of electrodes facing each other, a dielectric material positioned between the pair of electrodes wherein a gap is formed between at least one of the electrodes and the dielectric material, and an electrical power supply for applying an alternating or pulsed current to the pair of electrodes, and generating a plasma in a gas passing through the gap between the pair of electrodes to thereby modify the gas, wherein the average current density  $I_{rd}$  of the plasma thus generated satisfies the formula

$$10^{-4} \text{ A/cm}^2 \leq I_{rd} \leq 10^{-1} \text{ A/cm}^2.$$

2. A plasma reactor comprising a pair of electrodes facing each other, a dielectric material placed between the pair of electrodes wherein a gap is formed between at least one of the electrodes and the dielectric material, and an electrical power supply for applying an alternating or pulsed current to the pair of electrodes, and generating a plasma in a gas passing through the gap between the pair of electrodes to thereby modify the gas, wherein the formulas

$$0.1 \text{ mm} \leq t \leq 2.0 \text{ mm}$$

$$d + t \leq 5 \text{ mm}$$

$$d/t \leq 5$$

are satisfied when the total size of the gap is  $d$  and the thickness of the dielectric material is  $t$ .

3. A plasma reactor according to either one of Claim 1 or 2 wherein the dielectric material is not in contact with the electrodes.

4. A plasma reactor according to Claim 3 wherein the amount  $a$  that the center of the dielectric material in the width direction, is offset from the

midpoint of the distance between the pair of electrodes and satisfies the formula

$$0 \leq a \leq 0.5 \times (d / 2).$$

5. A method of determining abnormality in a plasma reactor having a pair of facing electrodes, comprising the steps of applying an alternating current to the electrodes for generating a plasma in a gas passing through the gap between the two electrodes to thereby modify the gas and monitoring the voltage or current waveform on the electrode, wherein the determination of abnormality is based on a change in the waveform of the voltage or current of the alternating current.

6. A method of determining abnormality in a plasma reactor according to Claim 5, further including the step of filtering the monitored voltage or current with a high-pass filter, wherein abnormality is determined if a spike-shaped abnormal waveform is detected when the waveform of the voltage or current of the alternating current is filtered by the high-pass filter.

7. A method of determining abnormality in a plasma reactor according to Claim 5, further including the step of comparing the waveform of the monitored voltage or current with a reference waveform, wherein abnormality is determined if a spike-shaped abnormal waveform is detected when the waveform of the voltage or current of the alternating current is compared with the reference waveform.